

Travel Model Improvement Program Webinar

Dynamic Traffic Assignment Session #1: DTA in a Nutshell

Question: What is Frank Wolfe?

Yi-Chang Chiu: It is a classical algorithm for solving the static assignment problem

Question: Would the recorded version of the webinar be available

Yi-Chang Chiu: Yes, please see Mr. Gary Thomas' earlier response

Question: What is "behavioral assumption"?

Yi-Chang Chiu: In solving what Travis is describing, we are making the behavioral assumption that users are self-optimizing (greedy), so if there is path with lower time (cost), travelers would switch, until the two paths have equal travel time (cost). Another behavioral assumption is that they know the time (cost) of all paths – through learning and experience. This plays a key in the late discussions. This corresponds to the 2nd assumptions mentioned in a few slides back - travelers are familiar with the system

Question: What is simplicial decomposition

Yi-Chang Chiu: Similar to static UE problem in which many solution algorithms exist, existing DTA models also employ a variety of algorithms. Simplicial decomposition is one of several algorithms that are out there. The original name actually comes from the Operations Research community.

Question: Is the Primer available on the TMIP website, or elsewhere?

Yi-Chang Chiu: The DTA primer will be available firstly at the TRB ADB30 network modeling committee website by TRB annual conference 2010 and it will also be published by TRB. At that time, we will also make the Primer available at the TMIP website.

Question: When will the Primer be available?

Yi-Chang Chiu: Please see above comments.

Question: What is a proper criterion for equilibrium.

Yi-Chang Chiu: It is the gap function based on path travel time (not flow). This is similar to what has been applied to the static UE problem.

Robert Farley, LA Co. MTA: You can read more on Simplicial Decomposition on Wikipedia http://en.wikipedia.org/wiki/Convex_polytope but it boils down to the math that allows an assignment as the summation of shortest path assignments

Question: How is DTA different from a sequence of static assignment?

Yi-Chang Chiu: There are fundamental differences. In a time-sliced static assignment (assuming this is what you meant), flows are not propagated from one slice to the next in a time-consistent manner. If you plot the flow from the same link over time slices, the flow is not relevant from one slice to the next, whereas in reality, traffic is continuous over time.

Question: For PM Peak hour modeling, do we need to model more than hour to take the effect of time based shortest path

Travel Model Improvement Program Webinar

Dynamic Traffic Assignment Session #1: DTA in a Nutshell

Yi-Chang Chiu: Certainly. For peak period modeling in DTA, you want to consider modeling over an extended period (at least 2-4 hours) to account for the onset and dissipation of congestion.

Question: What is the best practice to solve the $v/c > 1$ issue?

Yi-Chang Chiu: $v/c > 1$ is natural in static models as v represents non-capacity constrained demand assigned to links. $V/C > 0$ simply means that demand exceeds supply and congestion would form. However, using DTA, flow would be constrained by traffic dynamics and facility capacity; therefore, $v/c > 1$ generally won't occur.

Question: Were we wrong all along by using static assignment?

Yi-Chang Chiu: I probably would not make that conclusion. All models advances along time and research. DTA represents an opportunity to answer questions that cannot be answered by static models, but it is just recently getting mature and it comes with a higher resource requirements. It will take time and effort for the user community to realize the benefit/cost of DTA. For some applications, DTA may not be needed, depending on the requirements, and available resource.

Question: What is the advantage of activity-based model over 4-step models in the context of DTA?

Yi-Chang Chiu: I would perhaps suggest that DTA can represent a low-hanging-fruit improvement for the 4-step approach because it is more compatible with existing 4-step work flow and data. To make DTA work well with ABM, a more native integration is needed (in lieu of simple trip-table interface). More work is needed to make DTA works well (and conceptually consistent) with ABM. SPRP2 C10 is aimed at researching and developing this process and it is my understanding the once completed (2012), all models will be open-source.

Robert Farley, LA Co. MTA: A nomenclature I'm trying to advance is the use of D/C for static model results. Demand can exceed Capacity, but volume cannot

Question: How do we set the gap 0.01 or 0.001

Yi-Chang Chiu: This could vary largely from model to model. Not all existing DTA models have the exactly same gap function definition and the algorithmic implementation may constrain the convergence to different order of magnitude. But in general, we should expect a coarser convergence from DTA compared to static UE due to randomness in the simulation.

Question: In a 4-step model context, what is the best way to include DTA, replacing static assignment or as a stand-alone extra step?

Yi-Chang Chiu: Ideally, we can consider replacing the existing static assignment with DTA, but the reality is that in doing so one would be ready (willing) to wait longer for the results, and be willing to incorporate relatively more data into the model (e.g. signal, etc.) It is quite common that DTA is also used for stand-alone project (e.g. corridor studies.)

Question: Some literature suggests 0.00001 of relative gap is good for static models. what's the convergence level of DTA typically?

Yi-Chang Chiu: 0.01 - 0.05 is what have been reported in recent DTA literature.

Question: So it's fair to say that DTA lays somewhere in between static & activity based?

Yi-Chang Chiu: If you are debating on between 4-step and ABM, the main distinction would probably in anything other than the network component. DTA can assist in improvement the modeling realism in both 4-step and ABM.

Travel Model Improvement Program Webinar

Dynamic Traffic Assignment Session #1: DTA in a Nutshell

Question: Is the underlying behavioral assumption sensitive to socio-demographic attributes

Yi-Chang Chiu: Existing DTA models utilizes some sort of generalized cost to drive the equilibrium. The socio-demographic info can be incorporated but one needs to be careful in examining the convergence and how algorithms deal with this situation, depending on the model implementation.

Question: Does this 0.01-0.05 level indicate a "poorer" results in terms of equilibrium?

Yi-Chang Chiu: I would not say it is poorer compared with statics as in static everything is analytical and no randomness is present. With randomness present in simulation, it won't be practical to expect DTA convergence to go down to 0.0001

Travis Waller: To add some info on Lynne's question I saw. ABM typically only changes steps 1-3, it leaves step 4 (assignment) completely alone. So you can use ABM + static or ABM + dynamic. DTA and ABM therefore cover completely different parts of the problem.

Question: Would be fair to say that travel time skims generated from a DTA assignment could be longer than a static assignment for the same period because more queue delays are considered. So for a modal choice model using DTA skims could shift more trips to transit potentially?

Yi-Chang Chiu: This is an intuitive inference, but I would be careful in making such comparison unless the VDF and simulation can be perfectly calibrated/matched; otherwise, this comparison may be orange to apple because skim is the outcome of both assignment and network loading.

Question: Are there any commercial DTA software that can be used in a practical regional network? Are there any practical examples of working DTAs of any major MPOs?

Yi-Chang Chiu: There are practical example, but I cannot give specific names here. I need to avoid naming certain models, but participants are welcome to provide further info or exchange info offline.

Brian Gardner: Some case study examples of DTA's in practice will be included in later webinars.

Question: One of the earlier slides suggested that one calibration method was to adjust capacity to demand. Could you speak about this a bit more as it seems rather odd.

Yi-Chang Chiu: Generally we don't change supply during calibration. The supply side info needs to be properly calibrated/entered during the network construction stage. When all coding errors are fixed, OD may be adjusted but it is not recommended to adjust capacity arbitrarily as part of the calibration process.